

# PATENT SPECIFICATION

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## (54) IMPROVEMENTS IN AND RELATING TO ELECTRICAL MACHINES

(71) We, INTERNATIONAL RESEARCH & DEVELOPMENT COMPANY LIMITED, a British Company of Fossway, Newcastle-upon-Tyne NE6 2YD, do hereby declare the invention, for which we pray that a patent may be granted to use, and the method by which it is to be performed to be particularly described in and by the following statement:—

5 The present invention relates to an electrical machine having current transfer brushes composed of resilient fibres. The invention is an improvement in the invention described and claimed in our co-pending British Patent Application No. 14751/71 (Serial Number 1,396,309).

10 In that application it was proposed to provide an electrical machine with at least one current transfer brush composed of resilient fibres and co-operating with a current transfer surface and with positive-drive means for adjustment of the contact pressure between the brush and the current transfer device. In this way the wear rate

15 could be reduced while maintaining good electrical contact.

20 In accordance with the present invention there is provided an electrical machine having a plurality of current transfer brushes co-operating with a current transfer surface, each of the brushes being composed of resilient fibres and having a projecting peg

25 engaged in one of a plurality of grooves or slots of an annular actuating plate common to all the brushes, the said grooves or slots being so inclined that upon rotation of the actuating plate each of the brushes is positively driven in a radial direction to adjust the contact pressure between the

30 brushes and the current transfer surface, means being provided to guide each of the brushes in the said radial direction.

35 The actuating ring may be rotated manually whenever adjustment of the contact pressure is required and is then preferably locked in position. Alternatively, it may be rotated under automatic control in dependence upon some measured indication

40 of the degree of brush wear which has taken place.

45 The brush fibres may be metallic but in a preferred embodiment are high-strength carbon fibres with a metallic coating to increase their conductivity.

50 In an electric motor or generator in which the invention is employed the current transfer surface is a circular slip ring or commutator which surrounds or is surrounded by the brushes.

55 The invention will now be described in more detail with the aid of examples illustrated in the accompanying drawings, in which:—

60 Fig. 1 is an end elevation of a current collection system for application to the inside face of a slip ring in a homopolar generator in accordance with the invention.

65 Fig. 2 is a vertical cross-section of the current collection system of Fig. 1, and

70 Fig. 3 is an end elevation of a current collection system similar to that of Figs. 1 and 2 but applicable to the outside face of a slip ring.

75 In the current collection system shown in Figs. 1 and 2 a pair of annular actuating plates 10 each have on one face thirty-six arcuate guide slots 11 of which only those in the upper half are shown. The plates 10 are axially spaced and between them are disposed thirty-six current collection brushes 12. Each brush consists of an array of resilient carbon fibres with metal coatings as described in our British Patent Specification No. 1,191,234 or 1,388,123. This fibre array is secured to a brush top 13 which carries a pin 14 whose ends form pegs which project into one of the guide slots 11 in each of the actuating plates 10. Two retaining plates 15 enclose the assembly.

80 The brushes 12 are arranged for co-operation with the inside face of a surrounding slip ring (not shown). The electrical connection for each brush is provided by a sliding contact between the brush top 13 and a wedge-shaped member 16 which separates adjacent brushes. The

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members 16 are mounted between the fixed retaining plates 15.

The slots or grooves 11 are inclined between the radial and the tangential directions so that upon rotation of the actuating plates 10 relative to the plates 15, the pins 14 slide up the inclined slots and the brushes 12, which are radially guided by the members 16, advance or retract in a radial direction.

The amount of carbon fibre exposed beyond the brush top 13 determines the amount of wear which may be accommodated before replacement of the brushes becomes necessary. It is therefore arranged that the radial extent of the slots substantially corresponds with the length of exposed fibre when the brushes are first installed. Thus, initially, the location pins 14 are at the inside end of slots 11. When brush wear occurs it is arranged to either manually or automatically rotate the actuating members 10. The pins 14 thus follow the grooves 11 and move the brush tops radially outwards to increase the contact between the brush and the slip ring.

In the embodiment illustrated in Figs. 1 and 2 the thirty-six brushes are adjustable simultaneously over a range of 6 cm. by rotating the actuating plates 10 through an arc of 47°. The form of the grooves may be chosen to give a fixed increment of brush movement for each incremental angular movement of the actuating plates irrespective of the brush position.

Fig. 3 shows six brushes 12 which have brush tops 13 with pins 14 which engage in guide slots 11 in actuating plates 10. In this case the ends of the brushes 12 face inwardly to engage the outer surface of a slip ring 17 and the brushes can be positively driven inwards by rotation of the plates 10 instead of outwards as in the embodiment of Figs. 1 and 2.

It will be appreciated that the invention is not limited to the embodiments described in that the brushes can be used to take off power from the slip ring if used as a generator, or to supply power to the slip ring if used as a motor. The guide grooves need

not be of arcuate shape and may be straight.

It will also be appreciated that various means may be employed to adjust the relative positions of the brushes and the current transfer surfaces, for example, by means of servo-mechanisms as described in our British Patent Application No. 14757/71 Serial Number 1,396,309 as well as using the various sensing means to actuate the servo-mechanism to carry out the adjustment.

#### WHAT WE CLAIM IS:—

1. An electrical machine having a plurality of current transfer brushes co-operating with a current transfer surface, each of the brushes being composed of resilient fibres and having a projecting peg engaged in one of a plurality of grooves or slots of an annular actuating plate common to all the brushes, the said grooves or slots being so inclined that upon rotation of the actuating plate each of the brushes is positively driven in a radial direction to adjust the contact pressure between the brushes and the current transfer surface, means being provided to guide each of the brushes in the said radial direction.

2. An electrical machine as claimed in claim 1 having a pair of axially-spaced actuating plates with aligned grooves or slots in their facing surfaces, each brush having two pegs projecting into corresponding slots or grooves in the two actuating plates.

3. An electrical machine as claimed in claim 1 or 2 in which the resilient fibres are carbon fibres with a metal coating.

4. A machine as claimed in claim 1, 2 or 3 in which the slots or grooves are arcuate.

5. An electrical machine having a current transfer system substantially as described with reference to Figs. 1 and 2 or Fig. 3 of the accompanying drawings.

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                    Sheet 1

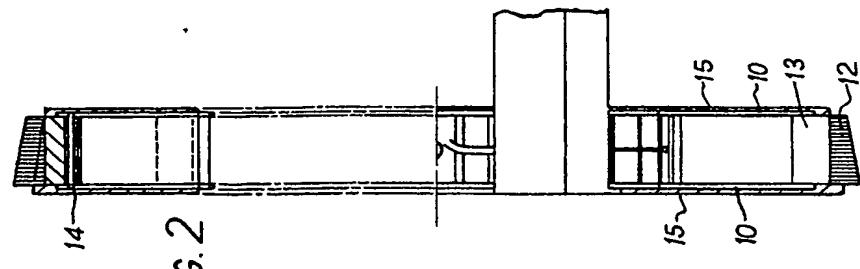


FIG. 2

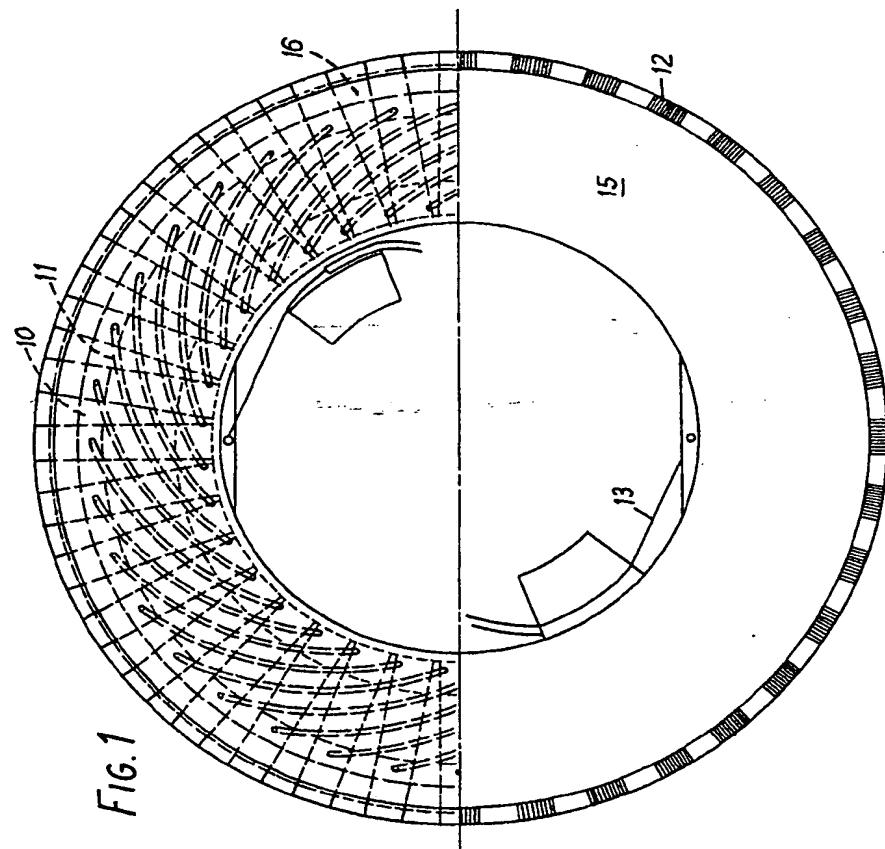


FIG. 1

1499808 COMPLETE SPECIFICATION

2 SHEETS This drawing is a reproduction of  
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Sheet 2

FIG. 3

